Resources, Tools and Basic Information for Engineering and Design of Technical Applications!

Thermal Conductivity of some common Materials

Thermal conductivity of some common materials as aluminum, asphalt, brass, copp and many more

Thermal conductivity is the quantity of heat transmitted through a unit thickness in a direction normal to a surface due to a unit temperature gradient under steady state conditions.

Thermal conductivity, or heat transfer coefficients, of some common materials and products can be found in the t

Thermal Conductivity - *k* - (W/m K)			
Material/Substance	Temperature (^oC)		
	25	125	225
Acetone	0.16		
Acrylic	0.2		
Air	0.024		
Alcohol	0.17		
Aluminum	250	255	250
Aluminum Oxide	30		
Ammonia	0.022		
Antimony	18.5		
Argon	0.016		
Asbestos-cement board	0.744		
Asbestos-cement sheets	0.166		
Asbestos-cement	2.07		
Asbestos, loosely packed	0.15		
Asphalt	0.75		
Balsa	0.048		
Bitumen	0.17		
Benzene	0.16		
Beryllium	218		
Brass	109		
Brick dense	1.31		
Brick work	0.69		
Cadmium	92		
Carbon	1.7		
Cement, portland	0.29		
Cement, mortar	1.73		
Cobalt	69		
Concrete	0.9 - 2		

Constantan	22		
Copper	401	400	398
Corian (ceramic filled)	1.06		
Corkboard	0.043		
Cork, regranulated	0.044		
Cork, ground	0.043		
Cotton	0.03		
Carbon Steel	54	51	47
Cotton Wool insulation	0.029		
Diatomaceous earth (Sil-o-cel)	0.06		
Ether	0.14		
Epoxy	0.35		
Felt insulation	0.04		
Fiberglass	0.04		
Fiber insulating board	0.048		
Fireclay brick 500°C	1.04		
Foam Glass	0.045		
Gasoline	0.15		
Glass	1.05		
Glass Pearls, dry	0.18		
Glass Pearls, saturated	0.76		
Glass Wool Insulation	0.04		
Glycerol	0.28		
Gold	310	312	310
Granite	1.7 - 4.0		
Gypsum or plaster board	0.17		
Hardboard high density	0.15		
Hardwoods (oak, maple..)	0.16		
Helium	0.142		
Hydrogen	0.168		
Ice	2.18		
Insulation materials	0.035 - 0.16		
Iridium	147		
Iron	80	68	60
Iron, wrought	59		
Iron, cast	55		
Kapok insulation	0.034		
Kerosene	0.15		
Lead Pb	35		
Leather	0.14		
Limestone	1.26 - 1.33		
Magnesia insulation	0.07		
Magnesium	156		
Marble	3		
Mercury	8		
Methane	0.030		

Methanol	0.21		
Mica	0.75		
Molybdenum	138		
Monel	26		
Nickel	91		
Nitrogen	0.024		
Nylon 6	0.25		
Oil, machine	0.15		
Olive oil	0.17		
Oxygen	0.024		
Paper	0.05		
Paraffin Wax	0.25		
Plaster, gypsum	0.48		
Plaster, metal lath	0.47		
Plaster, wood lath	0.28		
Platinum	70	71	72
Plywood	0.13		
Polyethylene HD	0.42 - 0.51		
Polypropylene	0.1 - 0.22		
Polystyrene expanded	0.03		
Porcelain	1.05		
PTFE	0.25		
PVC	0.19		
Pyrex glass	1.005		
Quarts mineral	3		
Rock Wool insulation	0.045		
Sand, dry	0.35		
Sand, saturated	2.7		
Saw Dust	0.06		
Silicone oil	0.1		
Silver	429		
Snow (temp < 0^oC)	0.05 - 0.25		
Sodium	84		
Softwoods (fir, pine ..)	0.12		
Steel	46		
Stainless Steel	16	17	19
Straw insulation	0.09		
Styrofoam	0.033		
Tin Sn	67		
Zinc Zn	116		
Vinyl ester	0.25		
Water	0.58		
Water, vapor (steam)		0.016	
Wood across the grain, white pine	0.12		
Wood across the grain, balsa	0.055		
Wood across the grain, yellow pine	0.147		

Wool felt	0.04		

- 1 W/(m.K) = 1 W/(m°.C) = 0.85984 kcal/(h.m.°C) = 0.5779 Btu/(ft.h.°F)
- What is conductive heat transfer?

Related Topics

- Insulation Heat transfer and heat loss from buildings and technical applications. Insulation methods and coeffi reduce energy consumption.
- Material Properties Material properties as densities, heat capacities for gases, fluids and solids ....
- Thermodynamics Thermodynamics studies the effects of changes in temperature, pressure, and volume on p at the macroscopic scale by analyzing the collective motion of their particles.

Related Documents

- Conductive Heat Transfer Heat transfer will take place as conduction when there exists a temperature gradier fluid
- Overall Heat Transfer Coefficient Calculating the overall heat transfer coefficient in walls or heat exchangers
- Mineral Wool Insulation Thermal conductivity - Temperature and k-values
- Thermal Conductivity of Metals Thermal conductivity of some common metals
- Insulation Materials and Temperature Ranges Temperature limits of some common insulation materials
- Resistivity from Conductivity Thermal resistivity and conductivity
- Thermal Transmittance - U Thermal transmittance - U - from thermal resistance
- Calcium Silicate Insulation Thermal conductivity - temperature and k-values

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7 3 23

- nautical miles

Convert !

Volume

1

- m^3
- liters
- in^3
- ft^3
- us gal

Convert !

Velocity

1

- m/s
- km/h
- ft/min
- ft/s
- mph
- knots

Convert !

Pressure

1

- Pa (N/m^2)
- bar
- mm H_2O
- kg/cm^2
- psi
- inches H_2O

Convert !

Flow

1

- m^3/s
- m^3/h
- US gpm
- cfm

Convert !

Unit Converter

ACCURATUS

Materials

Accuflect

Aluminum Nitride

Aluminum Oxide

Boron Nitride

Fused Silica

Macor

Mullite

Sialon

Silicon Carbide

Silicon Nitride

Zirconium Oxide

Boron Nitride, BN

Boron nitride is a white solid material in the as produced hot pressed form. I porosity solid. It is easily machined into complex shapes using standard carb The material is anisotropic in its electrical and mechanical properties due to hexagonal crystals and their orientation during the hot press consolidation.

Key Properties

- ✓ High thermal conductivity
- ✓ Low thermal expansion
- ✓ Good thermal shock resistance
- ✓ High electrical resistance
- ✓ Low dielectric constant and loss tangent
- ✓ Microwave transparency
- ✓ Non toxic
- ✓ Easily machined — non abrasive and lubricious
- ✓ Chemically inert
- ✓ Not wet by most molten metals

Typical Uses

- ✓ Electronic parts — heat sinks, substrates, coil forms, prototypes
- ✓ Boron doping wafers in silicon semiconductor processing
- ✓ Vacuum melting crucibles
- ✓ CVD crucibles
- ✓ Microcircuit packaging
- ✓ Sputtering targets
- ✓ High precision sealing, brazing, and metallizing fixtures
- ✓ Microwave tubes
- ✓ Horizontal caster break rings
- ✓ Low friction seals
- ✓ Plasma arc insulators
- ✓ High temperature furnace fixtures and supports

General Information

Boron nitride is often referred to as "white graphite" because it is a lubriciou the same platy hexagonal structure as carbon graphite. Unlike graphite, BN i electrical insulator. It offers very high thermal conductivity and good therma resistance. BN is stable in inert and reducing atmospheres up to 2800°C, and atmospheres to 850°C.

Three grades are commonly used, including a boric oxide binder system, a c: binder system, and a pure diffusion bonded grade. The boric oxide containin (Grade BO) absorbs moisture which causes swelling and property degradatic borate containing material (Grade CA) is moisture resistant. The pure BN m: XP) contains no binders and is used for extremes of temperature and where ı important. The boric oxide material is the most commonly used grade.

Engineering Properties*

Boron Nitride, Grade BO

	Units of Measure	Orientation to Pressin		
Mechanical	**SI/Metric (Imperial)**	**Parallel**		**Pe**
Density	gm/cc (lb/ft^3)	1.9	(120)	1.
Porosity	% (%)	2.8	2.8	2.
Color	—	white	white	wh
Flexural Strength	MPa (lb/in^{2}x10^3)	75.8	(11.0)	11
Elastic Modulus	GPa (lb/in^{2}x10^6)	46.9	(6.8)	73
Shear Modulus	GPa (lb/in^{2}x10^6)	—	—	—
Bulk Modulus	GPa (lb/in^{2}x10^6)	—	—	—
Poisson's Ratio	—	—	—	—
Compressive Strength	MPa (lb/in^{2}x10^3)	143	(20.8)	18
Hardness	Kg/mm^2	15-24	—	15-
Fracture Toughness K_{IC}	MPa•m$^{3/2}$	—	—	—
Maximum Use Temperature (inert atm)	°C (°F)	1800	(3250)	—
Thermal				
Thermal Conductivity	W/m•°K (BTU•in/ft^2•hr•°F)	30	(205)	3:
Coefficient of Thermal Expansion	10^{-6}/°C (10^{-6}/°F)	11.9	(6.6)	3.
Specific Heat	J/Kg•°K (Btu/lb•°F)	1610	(.38)	—
Electrical				
Dielectric Strength	ac-kv/mm (volts/mil)	95	(2400)	7!
Dielectric Constant	@ 8.8 GHz	4.6	—	4.

Dissipation Factor	@ 8.8 GHz	0.0017	—	0.0
Loss Tangent	—	—	—	—
Volume Resistivity	ohm•cm	>10^{14}	—	>1

Boron Nitride, Grade CA

	Units of Measure	Orientation to Pressin		
Mechanical	**SI/Metric (Imperial)**	**Parallel**		**P**
Density	gm/cc (lb/ft^3)	1.9	(120)	1.
Porosity	% (%)	15	15	1
Color	—	white	—	wh
Flexural Strength	MPa (lb/in^{2}x10^3)	43.4	(6.3)	6
Elastic Modulus	GPa (lb/in^{2}x10^6)	33.8	(4.9)	7
Shear Modulus	GPa (lb/in^{2}x10^6)	—	—	—
Bulk Modulus	GPa (lb/in^{2}x10^6)	—	—	—
Poisson's Ratio	—	—	—	—
Compressive Strength	MPa (lb/in^{2}x10^3)	30	(4.4)	44
Hardness	Kg/mm^2	14-18	—	14-
Fracture Toughness K_{IC}	MPa•m$^{1/2}$	—	—	—
Maximum Use Temperature (inert atm)	°C (°F)	1800	(3200)	—
Thermal				
Thermal Conductivity	W/m°K (BTU•in/ft^2•hr•°F)	27	(187)	3
Coefficient of Thermal Expansion	10^{-6}/°C (10^{-6}/°F)	2.95	(1.6)	.8
Specific Heat	J/Kg•°K (Btu/lb•°F)	1470	.35	—
Electrical				
Dielectric Strength	ac-kv/mm (volts/mil)	67	(1700)	—
Dielectric Constant	@ 8.8 GHz	4.3	—	4
Dissipation Factor	@ 8.8 GHz	0.0014	—	0.0
Loss Tangent	—	—	—	—
Volume Resistivity	ohm•cm	>10^{14}	—	>1

Boron Nitride, Grade XP

	Units of Measure	Orientation to Pressin		
Mechanical	**SI/Metric (Imperial)**	**Parallel**		**P**
Density	gm/cc (lb/ft^3)	1.9	(120)	1.

Porosity	% (%)	14	14	1
Color	—	white	white	wh
Flexural Strength	MPa (lb/in^2x10^3)	13.8	(2)	21
Elastic Modulus	GPa (lb/in^2x10^6)	14	(2)	—
Shear Modulus	GPa (lb/in^2x10^6)	—	—	—
Bulk Modulus	GPa (lb/in^2x10^6)	—	—	—
Poisson's Ratio	—	—	—	—
Compressive Strength	MPa (lb/in^2x10^3)	18	(2.6)	23
Hardness	Kg/mm^2	3-5	—	3-
Fracture Toughness K_{IC}	$MPa•m^{1/2}$	—	—	—
Maximum Use Temperature (inert atm)	°C (°F)	3000	(5400)	—
Thermal				
Thermal Conductivity	W/m•°K ($BTU•in/ft^2•hr•°F$)	71	(490)	12
Coefficient of Thermal Expansion	10^{-6}/°C (10^{-6}/°F)	0.6	(.33)	-.4
Specific Heat	J/Kg•°K (Btu/lb•°F)	1470	(.36)	—
Electrical				
Dielectric Strength	ac-kv/mm (volts/mil)	80	(2000)	8
Dielectric Constant	@ 8.8 GHz	4	—	4
Dissipation Factor	@ 8.8 GHz	0.0012	—	0.0
Loss Tangent	—	—	—	—
Volume Resistivity	ohm•cm	$>10^{14}$	—	>1

*All properties are room temperature values except as noted.
The data presented is typical of commercially available material and is offered for comparative purposes only. to be interpreted as absolute material properties nor does it constitute a representation or warranty for which w liability. User shall determine suitability of the material for the intended use and assumes all risk and liability wi connection therewith.

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